Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_

**Properties of Solids, Liquids, and Gases Lab**

**Introduction**

You will investigate five properties of liquids, gases and solids. This is a qualitative lab (non-numerical observations) in which you will determine if a state of matter (aka phase) has a particular property. If more than one phase has a particular property, then you will rank the phases from highest to lowest for that property. Here are the 5 properties and a brief description of each.

* Expansion – The ability of particles to fill any size or shape container. Particles that have this property are said to have no definite shape or volume.
* Fluidity – The ability of particles to slide past each other. Particles that have this property are said to have no definite shape.
* Diffusion – The spontaneous mixing of two or more substances cause by the random motion of the particles (in other words there is no outside force mixing them together).
* Effusion – The ability of a substance’s particles to pass through a tiny opening and escape a container.
* Compressibility – The ability of a substance’s particles to be pushed together so they occupy less volume than before.

**Compressibility Station**

Procedure - You will test the compressibility of gas (air), liquid (water), and solid (metal) using a plastic syringe.

1. With the cap off, pull back the plunger to fill the syringe with air.
2. Keeping your finger on the cap, push the plunger in as far as possible.
3. Observe how much the volume of the air decreases.
4. Repeat steps 1 through 3 using water. Be sure you do not have any air in the syringe.
5. Repeat steps 1 through 3 using a piece of metal. Be sure to observe how much the metal bolt compresses and not how much the rubber tip of the plunger compresses.

Data - Record your observations for each of the 3 phases.

|  |  |  |
| --- | --- | --- |
| Solid: | Liquid: | Gas: |

Conclusions – Use your observations to explain your answers to the following questions:

1. Which phase(s) have the property of compressibility?
2. If more than one phase has the property, rank the phases from most compressible to least compressible.

**Fluidity Station**

Procedure – You will test the fluidity of liquid (water) and solid (metal).

1. Fill a small beaker about half full of water.
2. Pour the water from the beaker into the small flask.
3. Observe if the water changed to the shape of the flask or if it retained its original “beaker” shape.
4. Dump out the water and repeat steps 1 through 3 for the steel washer.

Data – Record your observations for each of the two phases.

Conclusions – Use your observations to explain your answers to the following questions:

1. Which phase(s) have the property of fluidity?
2. We didn’t test the gas phase, but it does have the property of fluidity. If more than one phase has the property of fluidity, rank the phases from most fluid to least fluid.

**Expansion, Diffusion & Effusion Station**

Liquid Phase Procedure – You will test two liquids, water and food coloring, for the property of diffusion.

1. Fill a large beaker about two-thirds full of hot water.
2. Place one drop of food coloring in the water.
3. Observe the motion of the food coloring for several minutes to determine if 1) the clear liquid particles  and the food coloring particles mix on their own without any external stirring, 2) the liquid particles reach all areas of the beaker and 3) all the liquid particles remain in the beaker or if some of them escape the container.

Data – Record your observations from step #3.

Conclusions –Use your observations to explain your answers to the following questions about the liquid particles.

1. Do they have the property of diffusion?
2. Do they have the property of expansion?
3. Do they have the property of effusion?

**HEATING CURVE LAB**

**PURPOSE**

To graph the temperature of water in degrees Celsius as it changes phase from ice to liquid to gas.

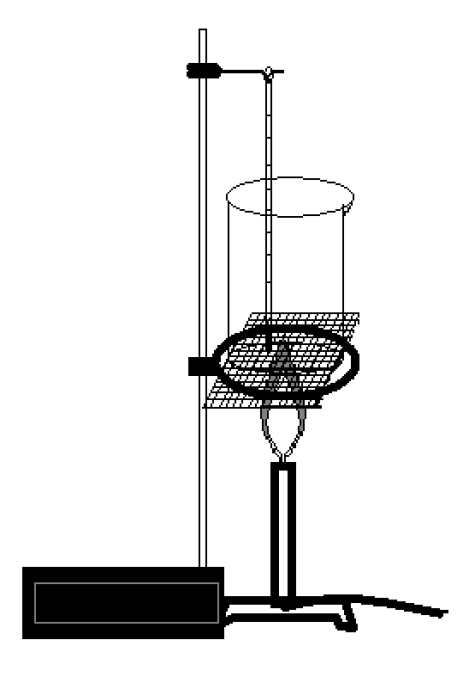
**SAFETY**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**MATERIALS**

* Ice
* Goggles
* 250-mL beaker
* Water
* Thermometer
* Bunsen burner
* Ring stand
* Iron ring
* Clamp
* Wire gauze
* Stopwatch
* Glass stirring rod
* Tongs

**PROCEDURE**

1. ☐Fill a 250-mL beaker with ice. Add just enough tap water to cover the ice.
2. ☐Place a wire gauze on the iron ring and the beaker on the wire gauze.
3. ☐Suspend the thermometer as deep in the ice water as possible without the bulb touching the bottom or sides.
4. ☐Light the alcohol burner, but do not put it under the beaker until you have adjusted the height of the beaker. You’ll want the bottom of the beaker to be right at the top of the inner blue cone of the flame.
5. ☐Record the beginning temperature of the ice water.
6. ☐Slide the burner under the beaker and start the timer.
7. ☐Read and record the temperature after each minute.
8. ☐You may wish to graph the points as you read them.
9. ☐When the water is above 90°C and has been boiling for 5 minutes, you may stop recording and shut off the flame.
10. ☐Allow the beaker and water to cool in place.

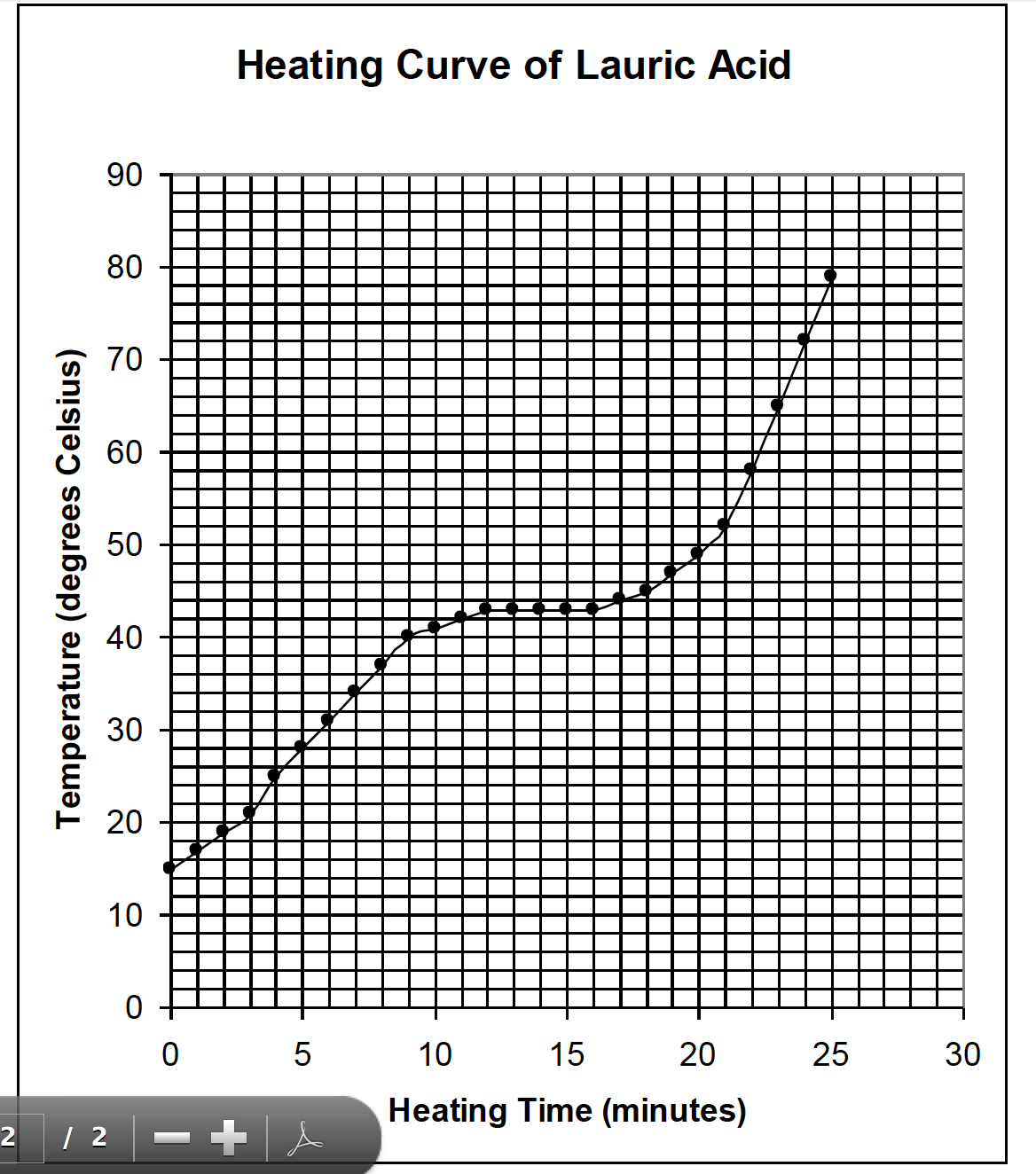
Data Table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Minute | Degrees Celsius | Minute | Degrees Celsius | Minute | Degrees Celsius |
| 1 |  | 6 |  | 11 |  |
| 2 |  | 7 |  | 12 |  |
| 3 |  | 8 |  | 13 |  |
| 4 |  | 9 |  | 14 |  |
| 5 |  | 10 |  | 15 |  |

Graph:



**CONCLUSION QUESTIONS (answer on a separate piece of paper)**

1. At what temperature did your ice melt? Explain how you know.
2. At what temperature did your water boil? Explain how you know.
3. If you were adding thermal energy (heat) the whole time, why did you have periods where your temperature did not change much? (What was the thermal energy doing during those time periods?)
4. Look at this graph of a waxy material called Lauric Acid. At what temperature does Lauric acid change from a solid to a liquid? \_\_\_\_\_\_\_\_\_\_\_\_ Describe why you chose this temperature from the graph.